A TAXONOMIC REVISION OF PODOCARPUS, XII. SECTION MICROCARPUS

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PODOCARPUS USTUS (Vieillard) Brongniart and Gris, the only species in section *Microcarpus*, is a very curious, small, twiggy shrub found in several places in the mountain forests of New Caledonia. Vieillard and Deplanche, the first collectors, said that the local residents regarded this plant as sacred and attributed marvelous properties to it. The scale-like leaves, similar to some found in section *Dacrycarpus*, are arranged spirally, covering the surface of the twig and adnate to the stem, often with only a millimeter of free leaf blade. A figure showing a vegetative branch and seeds is shown by Pilger (4, 5) in both of his treatments of the genus.

The species has been collected several times since it was described by Vieillard in 1862, but only the most recent collection, that of De Laubenfels (2) in 1957, has shown it growing parasitically on *Dacrydium taxoides* Brongn. & Gris. The color of the plant is variously described as reddish, copperish, bronze, or purple. As Luc Chevalier (1) describes it most recently, "ses rameaux dressés ressemblent à une branch de corail rouge et les cônes femelles au bout des rameaux sont d'un bleu roi légèrement argenté." Indeed, when I soaked some twigs in water in preparation for examination of the leaves, the water turned very reddish purple, the effect of known anthocyanins. In view of the possible absence of chlorophyll, a test was made by analyzing an alcoholic solution from the leaves in a Beckman photospectrometer. The absorption curve showed the drop at 650 millimicrons indicative of the presence of chlorophyll *a*.* These results indicate that the specimen examined most probably was not completely parasitic. It is interesting to note in this connection that the history of the collections shows, in almost every case, that *Dacrydium taxoides*, the host of this specimen, was collected at the same time as *Podocarpus ustus*. Since the knowledge of its semi-parasitic nature became available no further collections have been obtained, but one may reasonably suspect that the plant may prove to be a root-parasite on *Dacrydium* or other gymnosperms.

Podocarpus ustus (Vieillard) Brongniart & Gris, Bull. Soc. Bot. France 13: 426. 1866; Parlatore in DC. Prodr. 16: 521. 1868; Gordon, Pinetum ed. 2. 358. 1875; Warburg, Monsunia 1: 193. 1900; Pilger, Pflanzenr. IV. 5(Heft 18): 58. 1903, Nat. Pflanzenfam. ed. 2. 13:

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Dacrydium ustum Vieillard, Ann. Sci. Nat. Bot. IV. **16**: 56. 1862; Carrière, Conif. 697. 1867.

A shrub, usually less than 1 meter tall, with dense, short, erect spreading branches, with the twigs entirely clothed by the copperish to purple or red, spirally placed, persistent adpressed scale leaves (Fig. 1), and with the terminal meristems protected by the youngest leaves. Leaves triangular, carinate, with broadly decurrent bases, 1–2 mm. long, 1–1.5 mm. broad; midribs not evident. Leaves differentially amphistomatic, having few stomata on the adaxial surface. Leaves without hypodermis or palisade parenchyma. Male strobili terminal and solitary on axillary leaf-covered peduncles up to 6 mm. long, the strobili short-cylindrical, 5 mm. long. Microsporophylls imbricate, sessile, 1.5–2 mm. long, 2-locular, longitudinally dehiscing; apiculi flat, thin, and broadly triangular. Female strobili terminal; peduncles 2–5 mm. long, clothed in decussate scale leaves, the uppermost not decurrent, succeeded on the strobilus by about 5 spirally placed longer bracts increasing to 2.5 mm. with longer internodes and blades free from the axis; fertile bracts usually only one, sometimes two, terminal, mostly free from the ovules; no fleshy receptacle. Seed globose, purplish, to 2.5 mm., not crested but often drying so there is an apparent acute apex.

Distribution: In forests on mountain slopes, up to 1000 m. altitude, in New Caledonia.

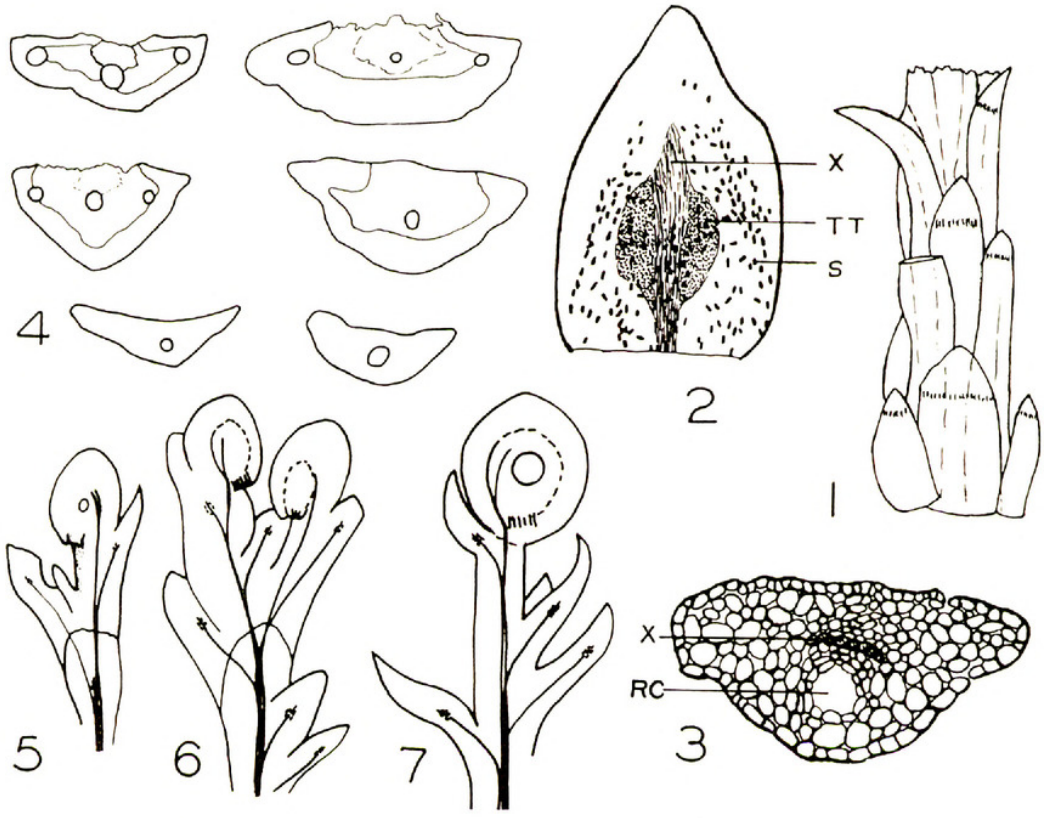
New Caledonia: Ignambi, *Compton 1545* (K *); Pic de Pouébo, *Vieillard 1269* (P), *Deplanche 170* (P); Mt. Penari, *Balansa 3484, 3485* (P); Koe, *Balansa 184* (†P); Mt. Koghi, *Brousmiche 456, 601* (P); Dumbea, *Vieillard 1262* (P); slopes above Rivière Bleue, *De Laubenfels P165* (†GA); Forets bas du Pic, des Sources, *LeRat 903* (†P); Montagnes de Poila, *Vieillard 1267* (†P-Type; †A, K); Baie de Prony, *Jeanneney* (P). No specific locality: *Balansa* (BM, K, †NY); *Pancher*, 1879 (†BR, K); *Hennecart* (BR, †P, †UCLA).

In contrast to the leaves of most other podocarps, which are noted for the variety of cell types in their tissues, there is little differentiation in the mesophyll of the leaves of *Podocarpus ustus*. The walls of the epidermal cells are mostly simple, and the often abundant stomata are mostly on the

* The following symbols indicate the location of the specimens cited: Arnold Arboretum (A); British Museum (Natural History) (BM); Brussels Botanical Garden (BR); University of California at Los Angeles (UCLA); Herbarium of the University of Georgia (GA); Royal Botanic Gardens, Kew (K); New York Botanical Garden (NY); Muséum National d'Histoire Naturelle, Paris (P).

† This symbol preceding the abbreviation of an herbarium signifies that the details of the leaves of this specimen have been examined in transverse section.

abaxial surface. The stomata are not arranged in rows, nor are they always oriented longitudinally (FIG. 2), merely being scattered over the surface. Only the smallest amount of vascular tissue connects with that of the stem and there is little vascular tissue in the free part of the blade of the leaf. Just before the bundle disappears the xylem tracheids shorten exceedingly and the vein broadens, with definite short wings of transfusion tissue on each side (FIG. 2), altogether giving a fan-like appearance to the termination of the bundle. The resin canal may continue beyond the end of the bundle but it rarely reaches the tip of the leaf; three resin canals may be present (FIG. 4). The blade of the leaf is swollen or fleshy and packed with roundish cells without conspicuous air spaces between them (FIG. 3). There is no palisade parenchyma and only rarely are a few isolated sclereids of the transfusion type seen.



FIGURES 1–7. **Podocarpus ustus.** 1, Part of stem, showing scale-leaves (*Vieillard 1267*), × 5. 2, Cleared leaf, showing vascular tissue and stomata in abaxial epidermis (*De Laubenfels P165*), × 16; S = stoma, X = xylem, TT = transfusion tissue. 3, Camera lucida outline of transverse section of leaf (from *De Laubenfels P165*), showing homogeneous mesophyll and resin canal (RC), × 35. 4, Outlines of transverse sections of leaves to show shape and one to three resin canals (*Balansa 184, 3485*), × 15. 5–7, Cleared ovulate strobili, all from *De Laubenfels P165*, × 7: 5, strobilus with very young ovule; 6, strobilus with two young ovules; 7, strobilus with older ovule.

The solitary ovules are terminal on the twigs (FIGS. 5–7). As in other podocarps, a single vascular bundle enters the ovuliferous scale but almost

immediately divides, both branches arching over the back to the top of the ovule. One of the specimens of *De Laubenfels P165* has pairs of ovules (FIG. 6) and close examination shows them to be separate on the uppermost bracts.

The lack of hypoderm in the leaves and the lack of a fleshy receptacle below the ovule definitely separate this species (and thus section *Microcarpus*) from section *Dacrycarpus*. If the scale leaves of *Podocarpus ustus* be considered merely evidence of modification toward the parasitic habit, then the species seems to be more closely related to section *Stachycarpus* where the other characters are typical. This position in the genus would be in better accord with the recent genetic studies in *Podocarpus* by Hair and Beuzenberg (3) who found that *P. ustus* has a diploid chromosome number of 36. They found chromosome numbers of 36 and 38 in section *Stachycarpus* and a diploid number in section *Dacrycarpus* of only 20.

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